Pneumonia

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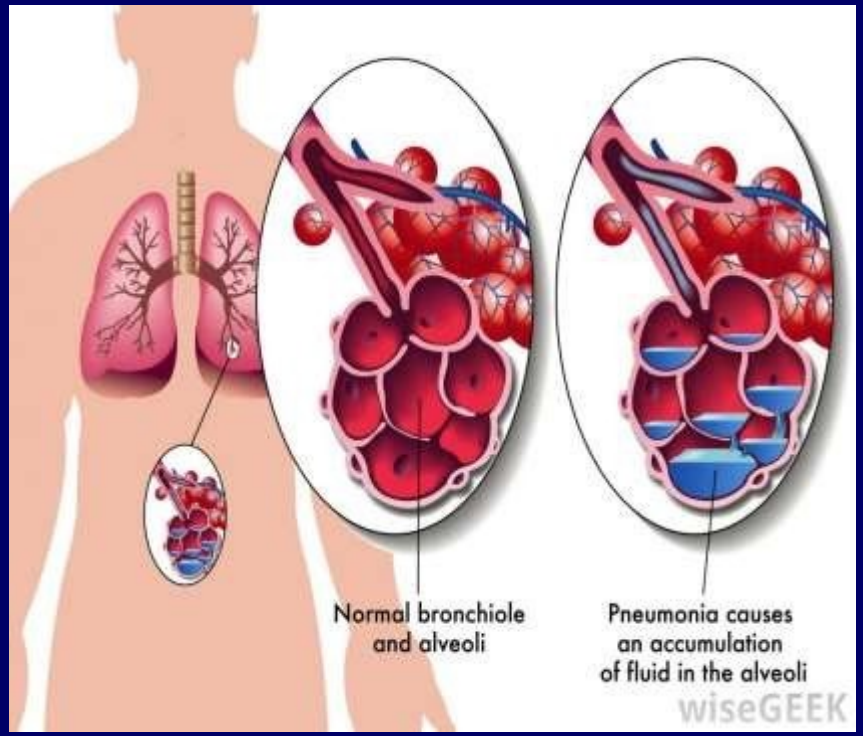
Outlines

- **Introduction**
- **Risk factors**
- **Pathogenesis**
- **Types**
- **Etiology**
- **Clinical features**
- **DDX**
- **Investigation**
- Complications
- **Treatment**
- **Special considerations**

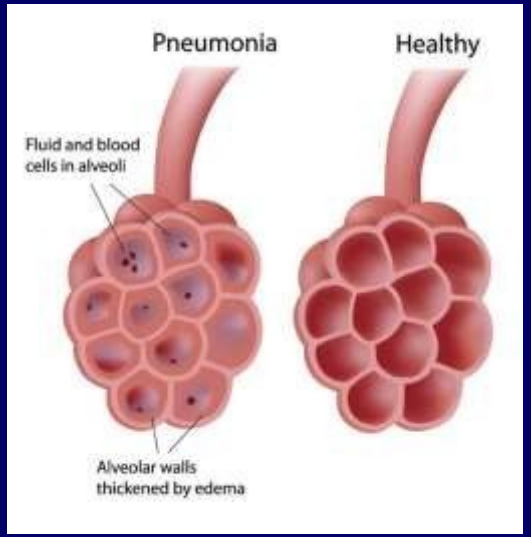
Pneumonia

- Pneumonia is an infection in one or both lungs.
- Pneumonia causes inflammation in the alveoli.
- The alveoli are filled with fluid or pus, making it difficult



DEFINITION

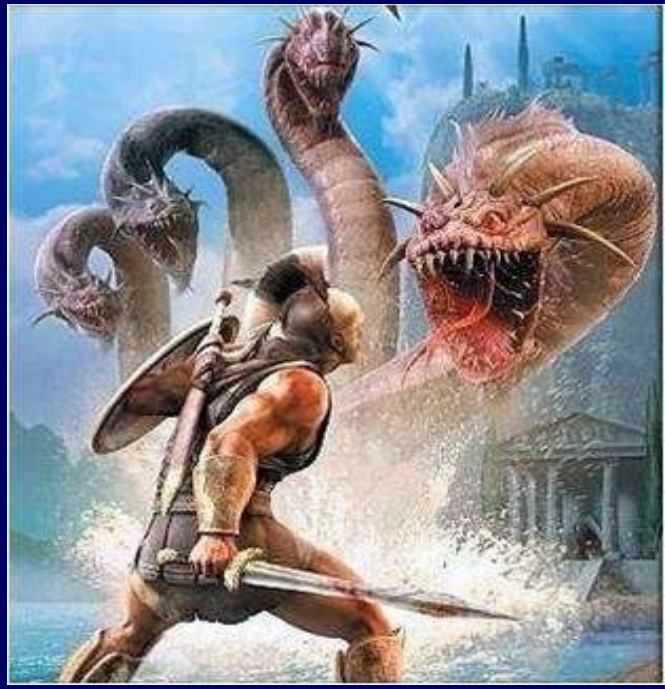
- “inflammation and consolidation of lung tissue due to an infectious agent”
- COSOLIDATION = ‘Inflammatory induration of a normally aerated lung due to the presence of cellular exudative in alveoli’



How does Pneumonia develop?

- Most of the time, the body filters organisms.
- This keeps the lungs from becoming infected.
- But organisms sometimes enter the lungs and cause infections.
- This is more likely to occur when:

·immune system is weak.
·organism is very strong.
·body fails to filter the organisms.



Factors that predispose to Pneumonia

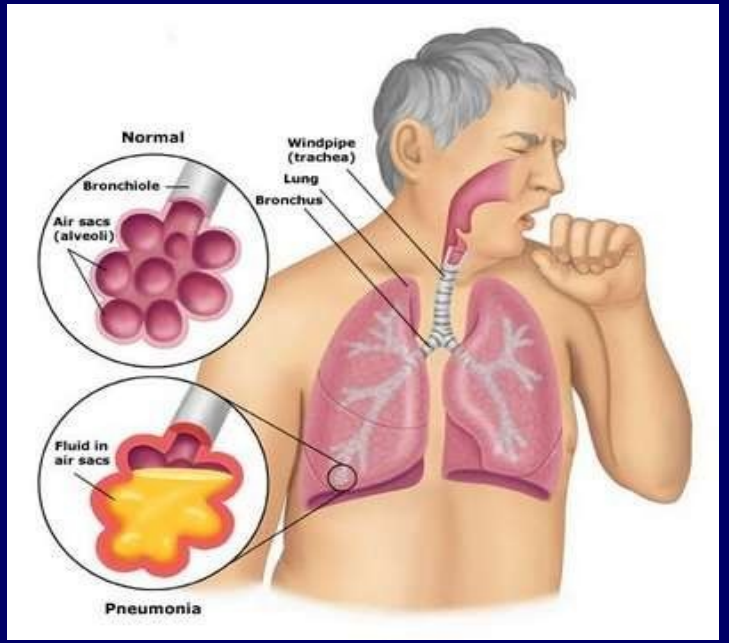
Cigarette smoking
Upper respiratory tract infections Alcohol
Corticosteroid therapy
Old age
Recent influenza infection Pre-existing lung disease
HIV
Indoor air polution

How does Pneumonia develop?

PATHOLOGY

Congestion

- Presence of a proteinaceous exudate—and often of bacteria—in the alveoli



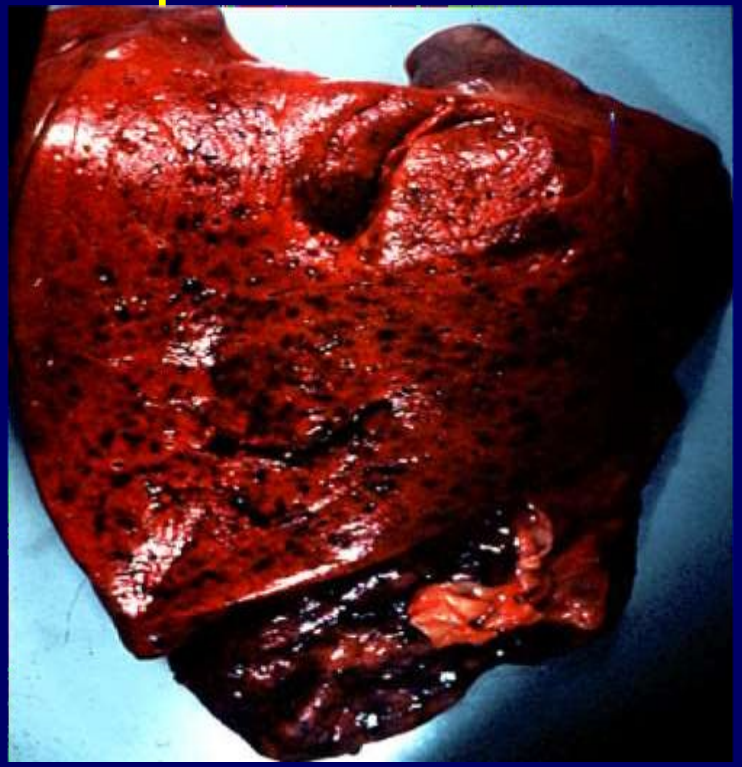
RED HEPATIZATION

- Presence of erythrocytes in the cellular intra alveolar exudate.
- As fibrin forms on the cut surface of the affected lobe, it resembles liver
- Neutrophils are also present

- Bacteria are occasionally seen in cultures of alveolar specimens collected

Normal Lung

Red Hepatization



GRAY HEPATIZATION

- No new erythrocytes are extravasating, and those already present have been lysed and degraded

- Neutrophil is the predominant cell
- Fibrin deposition is abundant

- Bacteria have disappeared
- Corresponds with successful containment of the infection and improvement in gas exchange

RESOLUTION

Macrophage is the dominant cell type in the alveolar space

Debris of neutrophils, bacteria, and fibrin has been cleared

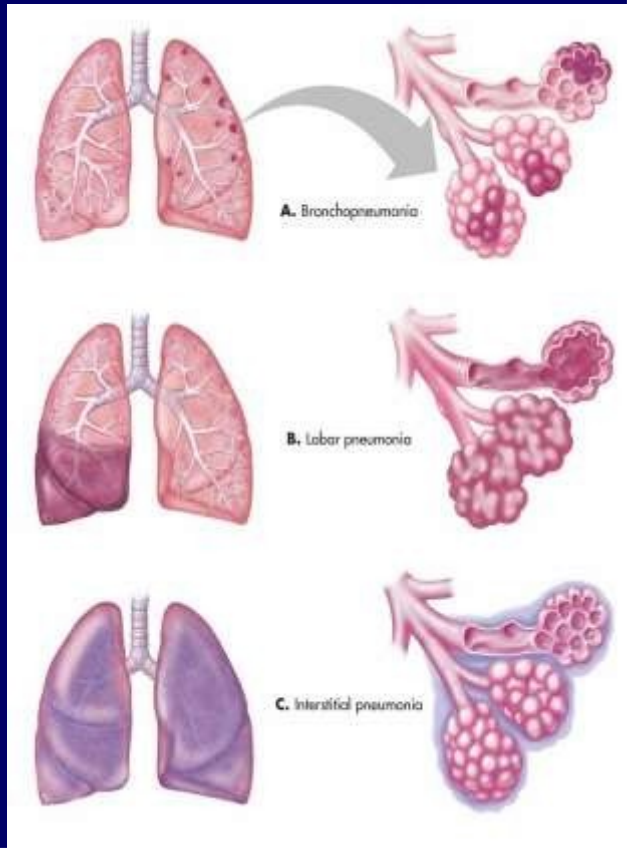
Types of Pneumonia

ANATOMICAL CLASSIFICATION

.Bronchopneumonia affects the lungs in
patches around bronchi

.Lobar pneumonia is an infection that only involves a single lobe, or section, of a lung.

.Interstitial pneumonia
involves the areas in between the alveoli



CLINICAL CLASSIFICATION

- Community Acquired - Typical/Atypical/Aspiration
- Nosocomial- HAP,VAP,HCAP

- Pneumonia in Immunocompromised host

Community Acquired Pneumonia (CAP)

DEFINITION:

- An infection of the pulmonary parenchyma Associated with symptoms of a/c infection
- Presence of a/c infiltrates on CXR or auscultatory findings consistent with Pneumonia

- In absence of immune compromise ,in a patient not hospitalized within the previous 30-90 days.

What is the epidemiology of CAP

- The WHO estimates that lower respiratory tract infection is the most common infectious cause of death in the world with almost 3.5 million deaths yearly.

- Every year in the United States, there are from 5-10 million cases of CAP leading to as many as 1.1 million hospitalizations and 45,000 deaths.

- In Europe, the overall incidence of community acquired lower respiratory tract infections (LRTIs) was found to be 44 cases per 1,000 populations per year in a single general practice

epidemiology

- It affects all age groups but is particularly common at the extremes of age.
- Worldwide, CAP continues to kill more children than any other illness, and its propensity to ease the passing of the frail and elderly led to pneumonia being known as the ‘old man’s friend’.

What is the etiology of CAP

- A microbiological diagnosis could be made in only 40– 71% of cases of CAP.
- Streptococcus pneumoniae is the most common etiological agent, but the proportion in different studies is variable .
- Viruses are responsible for CAP in as much as 10–36% of the cases.
- The widespread antibiotic (mis)use is probably responsible for decreasing culture rates in CAP.
- A ‘best guess’ as to the likely organism may be made from the context in which pneumonia develops, but not from the clinical

pneumonia.

Condition	Commonly encountered pathogen(s)
Alcoholism	*Streptococcus pneumoniae*, oral anaerobes, *Klebsiella pneumoniae*, *Acinetobacter* species, *Mycobacterium tuberculosis*
COPD and/or smoking	*Haemophilus influenzae*, *Pseudomonas aeruginosa*, *Legionella* species, *S. pneumoniae*, *Moraxella carar-rhalis*, *Chlamydophila pneumoniae*
Aspiration	Gram-negative enteric pathogens, oral anaerobes
Lung abscess	CA-MRSA, oral anaerobes, endemic fungal pneumonia, *M. tuberculosis*, atypical mycobacteria
Exposure to bat or bird droppings	*Histoplasma capsulatum*
Exposure to birds	*Chlamydophila psittaci* (if poultry: avian influenza)
Exposure to rabbits	*Francisella tularensis*
Exposure to farm animals or parturient cats	*Coxiella burnetti* (Q fever)
HIV infection (early)	*S. pneumoniae*, *H. influenzae*, *M. tuberculosis*
HIV infection (late)	The pathogens listed for early infection plus *Pneumocys-tis jirovecii*, *Cryptococcus*, *Histoplasma*, *Aspergillus*, atypical mycobacteria (especially *Mycobacterium kansasii*), *P. aeruginosa*, *H. influenzae*
Hotel or cruise ship stay in previous 2 weeks	*Legionella* species
Travel to or residence in southwestern United States	*Coccidioides* species, *Hantavirus*
Travel to or residence in Southeast and East Asia	*Burkholderia pseudomallei*, avian influenza, SARS
Influenza active in community	Influenza, *S. pneumoniae*, *Staphylococcus aureus*, *H. influenzae*
Cough >2 weeks with whoop or posttussive vomiting	*Bordetella pertussis*
Structural lung disease (e.g., bronchiectasis)	*Pseudomonas aeruginosa*, *Burkholderia cepacia*, *S. aureus*
Injection drug use	*S. aureus*, anaerobes, *M. tuberculosis*, *S. pneumoniae*
Endobronchial obstruction	Anaerobes, *S. pneumoniae*, *H. influenzae*, *S. aureus*
In context of bioterrorism	*Bacillus anthracis* (anthrax), *Yersinia pestis* (plague), *Francisella tularensis* (tularemia)

When to suspect pneumonia

- .pneumonia should be suspected in :
- Patient with acute illness with risk factor and one or more of the following features :
  - symptoms of lower respiratory tract such as cough ,pleuritic chest pain,....
  - SOB,or tachypnea
  - Persistent fever >4 days
  - New focal signs on chest examination

- (not every patient having acute cough or fever has pneumonia)

Clinical features

- Pneumonia, particularly lobar pneumonia, usually presents as an acute illness.
- Systemic features such as fever, rigors, shivering and malaise predominate and delirium may be present. The appetite is invariably lost and headache frequently reported, confusion may occurs
- Pulmonary symptom

include cough, which at first is characteristically short, painful and dry, but later accompanied by the expectoration of mucopurulent sputum. Rust-coloured sputum may be seen in patients with *Strep. pneumoniae*, and the occasional individual may report haemoptysis. Pleuritic chest pain may be a presenting feature and, on occasion, may be referred to the

Clinical features

- Examination
- General exam
- The respiratory and pulse rate may be raised and the blood pressure low
- An assessment of the mental state may reveal a delirium.
- These are important indicators of the severity of the illness
- pyrexia but this is helpful diagnostic clue if present.
- Oxygen saturation on air may be low,
- cyanosis and distress
- nutrition may poor
- herpes labialis may point to streptococcal infection
- rusty’ sputum may also point to streptococcal infection
- The presence of poor dental hygiene

Clinical features

Chest signs

- vary, depending on the phase of the inflammatory response.
- When consolidated dull to percussion and, as conduction of sound is enhanced, auscultation reveals bronchial breathing and whispering pectoriloquy; crackles are heard throughout.
- However, in many patients, signs are more subtle with reduced air entry only, but crackles are usually present.

ATYPICAL PNEUMONIA - Why ‘Atypical?

Clinically

- ✓ Subacute onset
- ✓ Fever less common or intense
- ✓ Minimal sputum

Microbiologically

- ✓ Sputum does not reveal a predominant microbial etiology on routine smears (Gram’s stain, Ziehl-Neelsen) or cultures

ATYPICAL PNEUMONIA - Why ‘Atypical’?

Radiologically

- Patchy infiltrates or
- Interstitial pattern

Haemogram

- Peripheral leukocytosis are less common or intense

ATYPICAL PNEUMONIA

- The term ‘atypical pneumonia’ has therefore been dropped

the term ‘‘atypical pathogens’’ is used to define infections caused by:

c Mycoplasma pneumoniae;
c Chlamydophila pneumoniae;
c Chlamydophila psittaci; and
c Coxiella burnetii.

- These pathogens are characterised by being difficult to diagnose early in the illness and are sensitive to antibiotics other than b-lactams such as macrolides tetracyclines or fluoroquinolones which are concentrated intracellularly, which is the usual site of replication of these pathogens.,

Differential diagnosis

19.43 Differential diagnosis of pneumonia

- Pulmonary infarction
- Pulmonary/pleural TB
- Pulmonary oedema (can be unilateral)
- Pulmonary eosinophilia (p. 713)
- Malignancy: bronchoalveolar cell carcinoma
- Rare disorders: cryptogenic organising pneumonia/ bronchiolitis obliterans organising pneumonia (COP/BOOP)

Investigations

The object of investigations is to confirm the diagnosis, assess the severity, identify the development of complications.

❖ Full blood count

• Very high (> 20 × 109/L) or low (< 4 × 109/L) white cell count: marker
of severity

• Neutrophil leucocytosis > 15 × 109/L: suggests bacterial aetiology

• Haemolytic anaemia: occasional complication of *Mycoplasma*

❖ Urea and electrolytes

Urea > 7 mmol/L (~20 mg/dL): marker of severity

❖ Hyponatraemia: marker of severity ,legionella

❖ Liver function tests:

• Abnormal if basal pneumonia inflames liver, legionellae

Radiology

❖Chest X-ray

All patients admitted to hospital with suspected CAP should have a chest radiograph performed as soon as possible to confirm or refute the diagnosis

Lobar pneumonia

• Patchy opacification evolves into homogeneous consolidation of affected lobe

• Air bronchogram (air-filled bronchi appear lucent against consolidated lung tissue) may be present

Bronchopneumonia

• Typically patchy and segmental shadowing

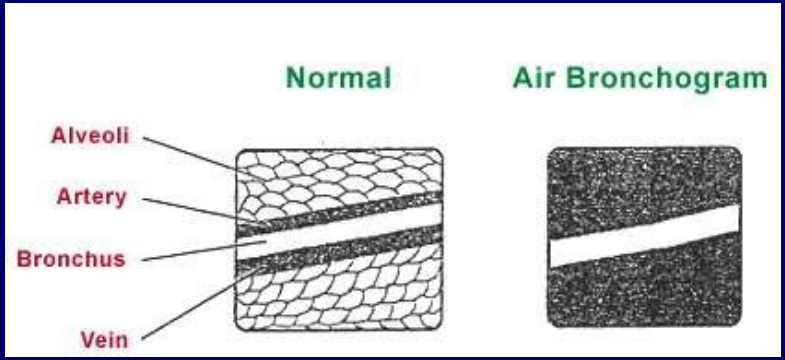
Complications

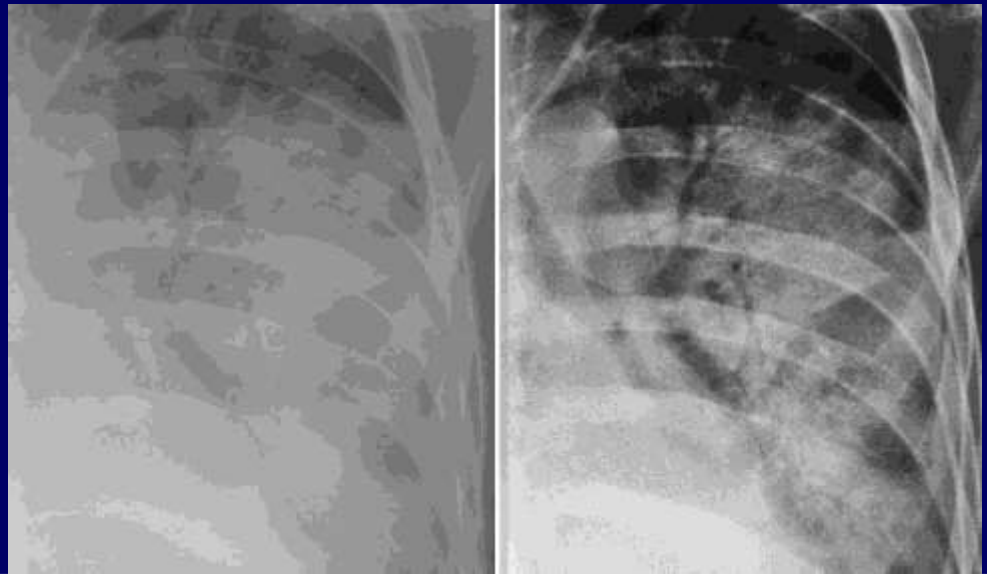
• Para-pneumonic effusion, intrapulmonary abscess or empyema

Staph. aureus

X Ray

Homogenous opacity with air bronchogram



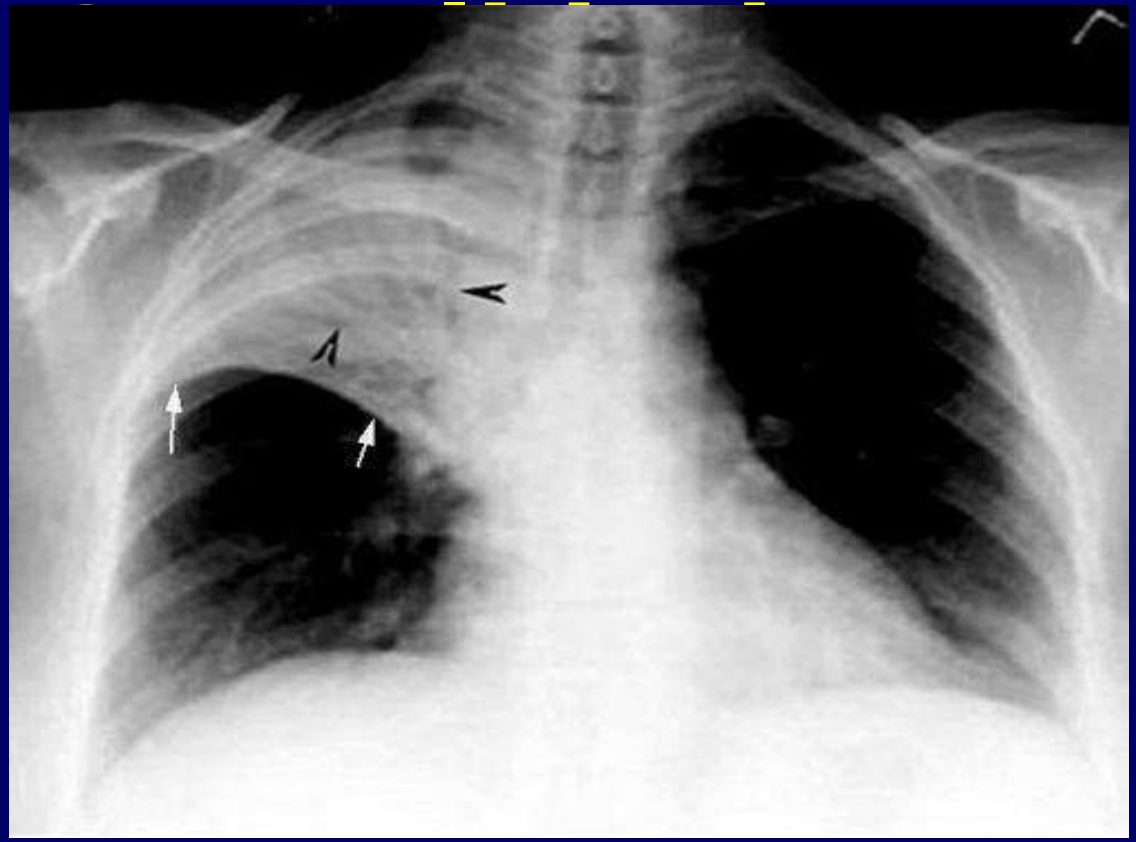


LOBAR PNEUMONIA

- Peripheral airspace consolidation pneumonia

Without prominent involvement of the bronchial tree

RUL



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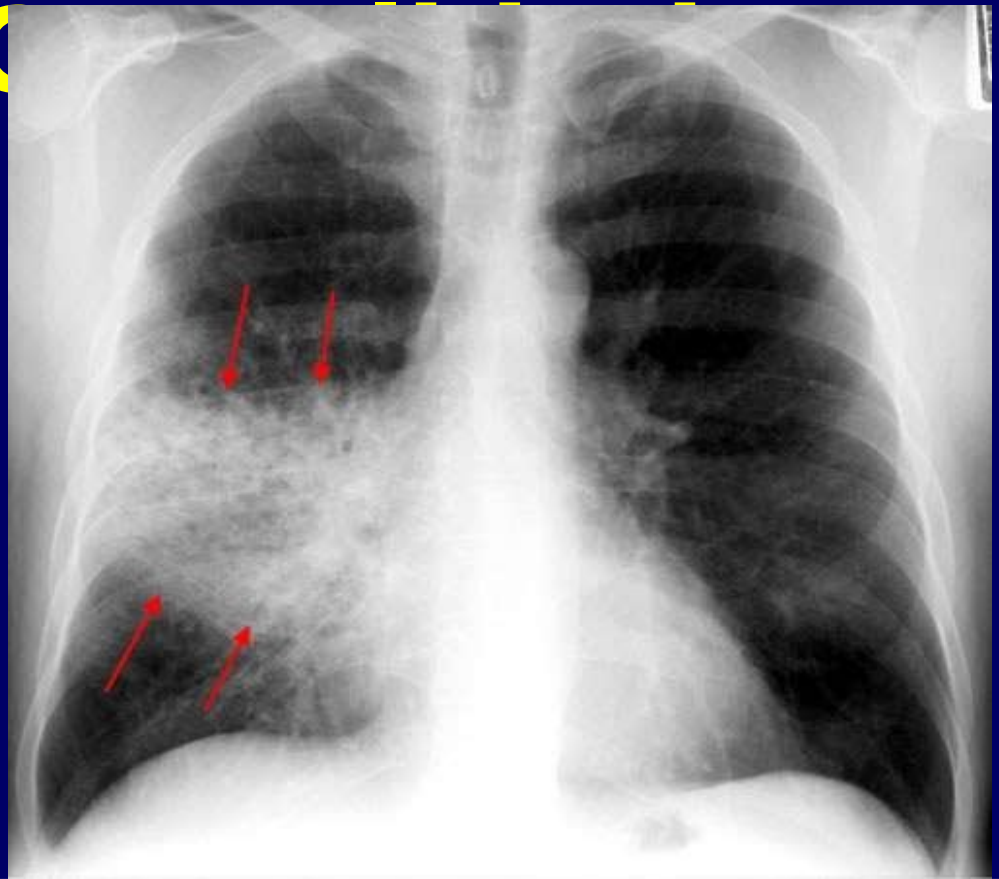


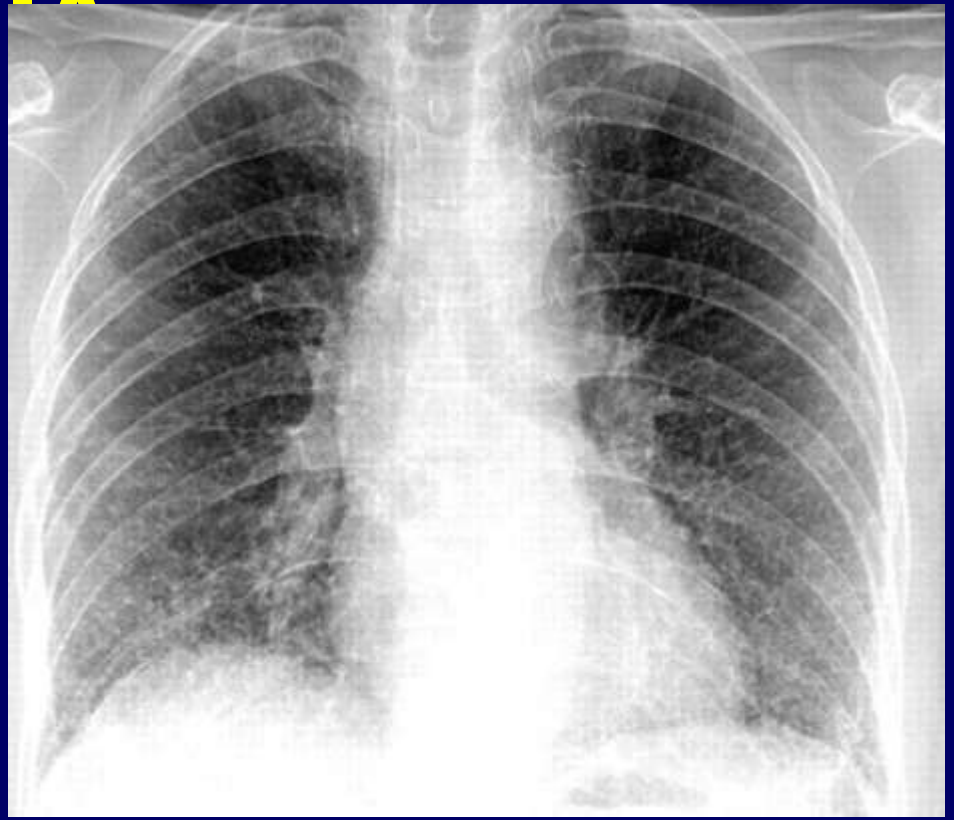
BRONCHOPNEUMONIA

- Centrilobular and Peribronchiolar opacity pneumonia
- Tends to be multifocal

·Patchy in distribution rather than localized to any one lung region

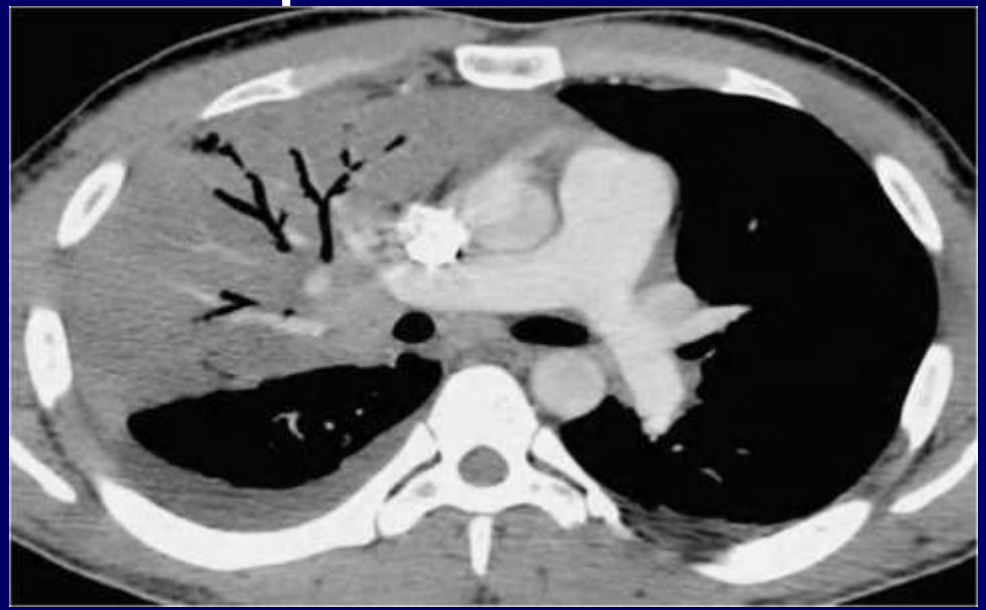
INTERSTITIAL PNEUMONIA

- Peribronchovascular Infiltrate
- Mycoplasma , viral



CT THORAX

Seldom



Objective measures

check Oxygenation saturation by pulse oximetry for all patients and, where necessary, arterial blood gases

microbiological investigations

- Microbiological tests should be performed on all patients with moderate and high severity CAP, the extent of investigation in these

patients being guided by severity.

- Routine diagnostic tests to identify an etiologic diagnosis are optional for outpatients with CAP, are not recommended routinely.
- For patients with low severity CAP the extent of microbiological investigations should be guided by clinical factors (age, comorbid

illness, severity indicators), epidemiological factors and prior antibiotic therapy.

microbiological investigations

- In the community
- ✓ Examination of sputum should be considered for patients who do not respond to empirical antibiotic therapy.
- ✓ Examination of sputum for Mycobacterium tuberculosis should be considered for patients with a persistent productive cough, especially if malaise, weight loss or night sweats, or risk factors for tuberculosis (eg, ethnic origin, social deprivation, elderly) are present.
- ✓ Urine antigen investigations, PCR of upper (eg, nose and throat swabs) or lower (eg, sputum) respiratory tract samples or serological investigations may be considered during outbreaks (eg, Legionnaires' disease) or epidemic mycoplasma years, or when there is a particular clinical or

microbiological investigations

Blood cultures

- Blood cultures are recommended for all patients with moderate and high severity CAP, preferably before antibiotic therapy is started.
- If a diagnosis of CAP has been definitely confirmed and a patient has low severity pneumonia with no comorbid disease, blood cultures may be omitted.

Sputum cultures

- . Sputum samples should be sent for gram stain, culture and sensitivity tests from patients with CAP of high severity, moderate severity who are able to expectorate purulent samples and have not received prior antibiotic therapy. Specimens should be transported rapidly to the laboratory.
- Culture of sputum also in these not responding treatment

Other investigations

Serology

• Acute and convalescent titres for *Mycoplasma*, *Chlamydia*, *Legionella* and viral infections

Cold agglutinins

• Positive in 50% of patients with *Mycoplasma*

Urine

• Pneumococcal and/or *Legionella* antigen

Pleural fluid

• Always aspirate and culture when present in more than trivial amounts, preferably with ultrasound guidance.

Complications of pneumonia

- ✓ Para-pneumonic effusion – common
- ✓ Empyema
- ✓ Retention of sputum causing lobar collapse
- ✓ Deep vein thrombosis and pulmonary embolism
- ✓ Pneumothorax, particularly with Staphylococcus aureus
- ✓ Suppurative pneumonia/lung abscess
- ✓ ARDS, renal failure, multi-organ failure
- ✓ Ectopic abscess formation (Staph. aureus)
- ✓ Hepatitis, pericarditis, myocarditis, meningoencephalitis
- ✓ Arrhythmias (e.g. atrial fibrillation)
- ✓ Pyrexia due to drug hypersensitivity

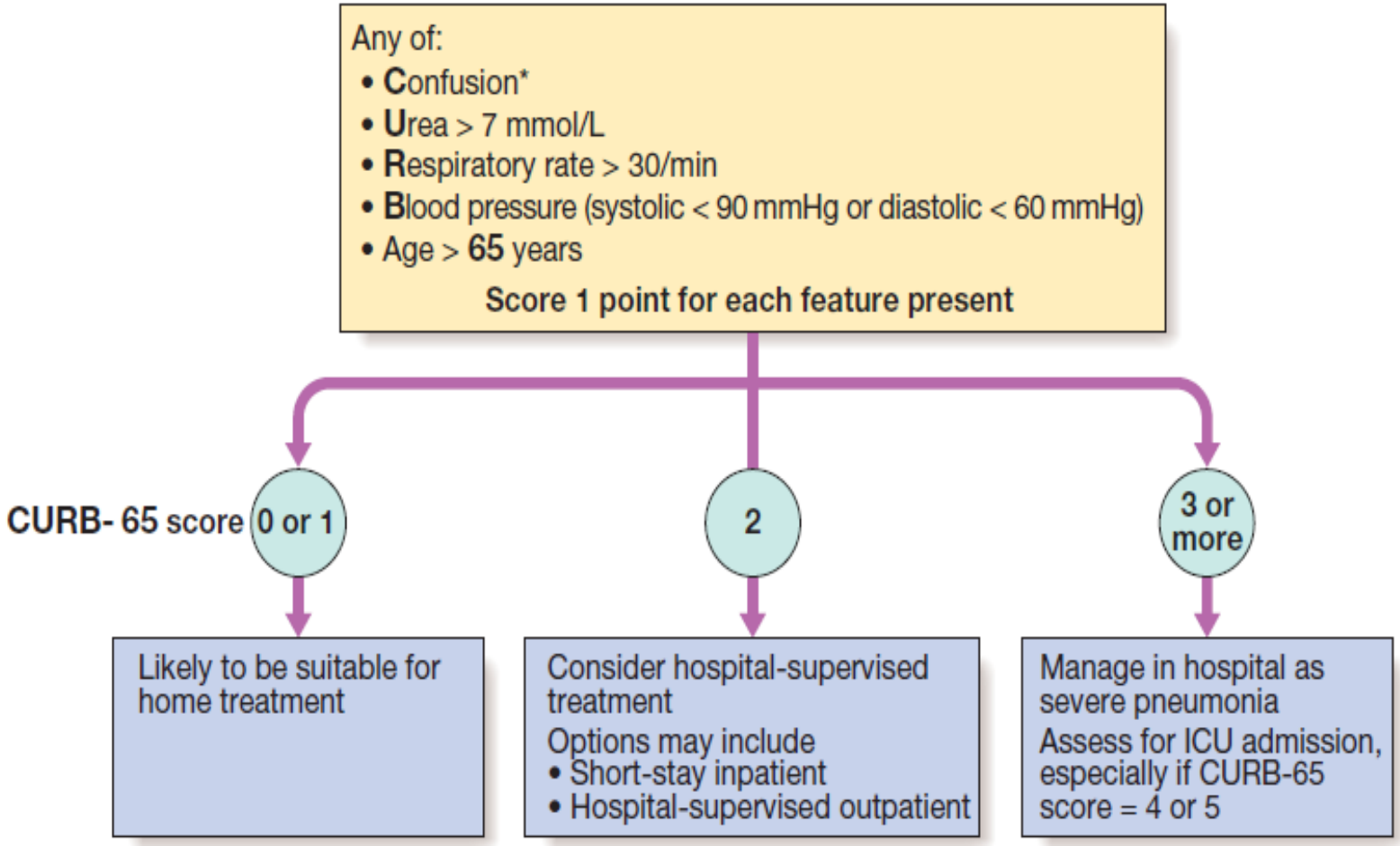
Pneumonia complications

SLAPHER *(please don't(*

- S - Septicaemia
- L - Lung abcess
- A - ARDS
- P - Para-pneumonic effusions
- H - Hypotension
- E - Empyema
- R - Respiratory failure /renal failure

Initial Assessment

Hx and examination
Investigation
Severity assesment
Need of hospitilization


Any of:
• Confusion*
• Urea > 7 mmol/L
• Respiratory rate > 30/min
• Blood pressure (systolic < 90 mmHg or diastolic < 60 mmHg)
• Age > 65 years
Score 1 point for each feature present
CURB- 65 score
0 or 1
2
3 or more
Likely to be suitable for home treatment
Consider hospital-supervised treatment
Options may include
• Short-stay inpatient
• Hospital-supervised outpatient
Manage in hospital as severe pneumonia
Assess for ICU admission, especially if CURB-65 score = 4 or 5

Severity assessment of CAP in patients seen in the community or primary care

- ✓ For all patients, clinical judgment supported by the CRB65 score should be applied when deciding whether to treat at home or refer to hospital.
- ✓ Patients who have a CRB65 score of 0 are at low risk of death and do not normally require hospitalization for clinical reasons.
- ✓ Patients who have a CRB65 score of 1 or 2 are at increased risk of death, particularly with a score of 2, and hospital referral and assessment should be considered.
- ✓ Patients who have a CRB65 score of 3 or more are at high risk of death and require urgent hospital admission.
- ✓ When deciding on home treatment, the patient's social circumstances and wishes must be taken into account in all

Severe pneumonia

CRB 65 2 or more in community
Curb 65 3 or more in hospital
Pneumonia severity index
any major criteria or 3 minor criteria

PNEUMONIA SEVERITY INDEX

Minor criteria
Respiratory rate 30 breaths/min
PaO2/FiO2 ratio 250
Multilobar infiltrates
Confusion/disorientation
Uremia (BUN level, 20 mg/dL)
Leukopenia (WBC count, !4000 cells/mm3)
Thrombocytopenia (platelet count, !100,000 cells/mm3)
Hypothermia (core temperature, !36C)
Hypotension requiring aggressive fluid resuscitation
Major criteria
Invasive mechanical ventilation need
Septic shock with the need for vasopressors

Severe pneumonia

.

Other criteria to consider

- ✓ include hypoglycemia (in nondiabetic patients),
- ✓ acute alcoholism/alcoholic withdrawal,
- ✓ hyponatremia, unexplained metabolic acidosis or elevated lactate level,
- ✓ cirrhosis, and asplenia.
- ✓ A need for noninvasive ventilation can substitute for a respiratory rate 30 breaths/min or a PaO2/FiO2 ratio !250.

c As a result of infection alone.

Indications of hospitalization

- The decision depends on the following
  - Severity scores
  - Assessment of functional status
  - Evaluation of instable comorbidity
  - Measurement of oxygen saturation

Indications of hospitalization

- CRB 1 or more
- CURB 2 or more
- Severe pneumonia in PSI
- Other indications
- ✓ complications of the pneumonia itself
- ✓ exacerbation of underlying diseases
- ✓ inability to reliably take oral medications or receive outpatient care
- ✓ multiple risk factors falling just above or below thresholds for the score
- ✓ An arterial saturation of !90% or an arterial oxygen pressure (PaO2) of !60 mm Hg as a complication of the pneumonia

Indications of hospitalization

- ✓ pleural effusion,
- ✓ lack of response to previous adequate empirical antibiotic Therapy
- ✓ Other medical or psychosocial needs

requiring hospital care include intractable vomiting, injection drug abuse, severe psychiatric illness, homelessness, poor overall
functional status , and cognitive dysfunction.

- ✓ Also, the presence of rare illnesses such as neuromuscular or sickle cell disease, may require hospitalization

but not affect the PSI score.

Indications for referral to ITU

- ✓ CURB score of 4–5 , failing to respond rapidly to initial management
- ✓ Persisting hypoxia (PaO_2 < 8 kPa (60 mmHg)), despite high concentrations of oxygen
- ✓ Progressive hypercapnia
- ✓ Severe acidosis
- ✓ Circulatory shock
- ✓ Reduced conscious level
- ✓ Major criteria or 3 or more minor criteria of PSI

General management strategy for patients treated in the community

- ✓ Rest
- ✓ Drink plenty of fluids
- ✓ Avoid smoking.
- ✓ Pleuritic pain should be relieved using simple analgesia such as paracetamol
- ✓ Oral antibiotics
- ✓ Follow up 2-3 days ,reassement

General management strategy for patients treated in hospital

- oxygen therapy
- ✓ All patients should receive appropriate oxygen therapy with monitoring of oxygen saturations and inspired oxygen concentration with the aim to maintain arterial oxygen tension (Pao2) at ≥8 kPa and oxygen saturation (Spo2) 94–98%. High concentrations of oxygen can safely be given in patients who are not at risk of hypercapnic respiratory failure.

Oxygen therapy in patients at risk of hypercapnic respiratory failure complicated by ventilatory failure should be guided by repeated arterial blood gas measurements.

- ➢ Patients should be assessed for volume depletion and may require intravenous fluids.
- ➢ Prophylaxis of venous thromboembolism with heparin if not

General management strategy for patients treated in hospital

- . Nutritional support should be given in prolonged illness.
- . Medical condition permitting, patients admitted to hospital with uncomplicated CAP should sit out of bed for at least 20 min within the first 24 h and mobility should be increased each subsequent day of hospitalisation.
- Patients admitted with uncomplicated pneumonia should not be treated with traditional airway clearance techniques routinely.
- Patients should be offered advice regarding expectoration if there is sputum present. [D]
- Airway clearance techniques should be considered if the patient has sputum and difficulty with expectoration or in the event of a pre-existing lung condition

Antibiotic management

Time to start

Within 4 hrs of presentation

Before transfer if delay 6 hrs is suspected .

Recommended empirical antibiotics for communityacquired pneumonia

Outpatient treatment

1. Previously healthy and no use of antimicrobials within the previous 3 months

A macrolide (strong recommendation; level I evidence) or Doxycycline or amoxicillin

2. Presence of comorbidities such as chronic heart, lung, liver or renal disease; diabetes mellitus; alcoholism; malignancies; asplenia; immunosuppressing conditions or use of immunosuppressing drugs; or use of antimicrobials within the previous 3 months (in which case an alternative from a different class should be selected)

- A respiratory fluoroquinolone (moxifloxacin, gemifloxacin, or levofloxacin [750 mg]) (strong recommendation; level I evidence)

Recommended empirical antibiotics for community acquired pneumonia

3. In regions with a high rate (125%) of infection with high-level (MIC 16 mg/mL) macrolide-resistant Streptococcus pneumoniae,
consider use of alternative agents listed above in
(2) for patients without comorbidities (moderate recommendation;
level III evidence

Inpatients, non-ICU treatment

A respiratory fluoroquinolone (strong recommendation; level I evidence)

A b-lactam **plus** a macrolide (strong recommendation; level I evidence)

Recommended empirical antibiotics for community acquired pneumonia

Inpatients, ICU treatment

A b-lactam (cefotaxime, ceftriaxone, or ampicillin-sulbactam) plus either azithromycin (level II evidence) or a respiratory fluoroquinolone (level I evidence) (strong recommendation) (for penicillin-allergic patients, a respiratory fluoroquinolone and aztreonam are recommended)

Recommended empirical antibiotics for community acquired pneumonia

Special concerns

If Pseudomonas is a consideration
(known pseudomonas colonization,prior pseudomonas infection,detection of gram negative rods on sputum,prior iv antibiotic use in previous 90 days ,advance COPD with frequent exacerbations ,other structural lung diseases such as cystic fibrosis or bronchectasis,
Immunocomprmized.

- ✓ An antipneumococcal, antipseudomonal b-lactam (piperacillintazobactam, cefepime, imipenem, or meropenem) plus
  either ciprofloxacin or levofloxacin (750 mg)

or

Recommended empirical antibiotics for community acquired pneumonia

or

The above b-lactam plus an aminoglycoside and an antipneumococcal
fluoroquinolone (for penicillin-allergic patients, substitute aztreonam for above b-lactam)

If CA-MRSA is a consideration(known MRSA colonization,prior MRSA infection,detection of gram positive cocci in clusters, sputum,prior iv antibiotic use in previous 90 days,recent influenza infection,necrotizing or cavitary pneumonia ,empyema ,immunsuppresion,end stage kidny disease
, add vancomycin or linezolid
(moderate recommendation; level III evidence

Recommended empirical antibiotics for community acquired pneumonia

Duration of antibiotics

For patients managed in the community and for most patients admitted to hospital with low or moderate severity and uncomplicated pneumonia,

7 days of appropriate antibiotics is recommended

For those with high severity microbiologically-undefined pneumonia, 7–10 days of treatment is proposed. This may need to be extended to 14 or 21 days according to clinical judgement; for example, where Staphylococcus aureus or Gram-negative enteric bacilli pneumonia is suspected or confirmed.

Oral versus parentral Abs

The oral route is recommended in those with low and moderate severity CAP,parentral for high severe pneumonia .

Monitoring in hospital

- ✓ Temperature, respiratory rate, pulse, blood pressure, mental status, oxygen saturation and inspired oxygen concentration should be monitored and recorded initially at least twice daily and more frequently in those with severe pneumonia or requiring regular oxygen therapy. .
- ✓ C-reactive protein should be remeasured and a chest radiograph repeated in patients who are not progressing satisfactorily after 3 days of treatment. [B+]
- ✓ Patients should be reviewed within 24 h of planned discharge home

Criteria for discharge

The decision to discharge a hospitalised patient depends on the home circumstances and the likelihood of complications. those suitable for discharge should not have more than one of the following characteristics present (unless they represent the usual baseline status for that patient):

- temperature >37.8°C, heart rate >100/min, respiratory rate >24/min, systolic blood pressure <90 mm Hg, oxygen saturation <90%, inability to maintain oral intake and abnormal mental status.

follow-up

- ✓ Clinical review by GP or hospital should be arranged around 6 weeks later and a chest X-ray obtained if there are persistent symptoms, physical signs or reasons to suspect underlying malignancy
- ✓ All patients aged .65 years or at risk of invasive pneumococcal disease who are admitted with CAP and who have not previously received pneumococcal vaccine should receive 23-valent pneumococcal polysaccharide

NONRESOLVING PNEUMONIA

IDSA broadly classifies nonresponse into 2 different groups: (1) progressive pneumonia characterized by clinical deterioration and (2) persistent pneumonia with absence or delay of clinical stability.

Progressive pneumonia with deterioration is characterized by respiratory failure and/ or septic shock and typically occurs within 72 hours. Persistent pneumonia with absent or delayed response is typically considered after a time period of 72 hours

Table 5
BAD OMEN (nonresolving pneumonia)

Disease/Risk Factor Mnemonic	Listing of Diseases/Conditions/Risk Factors
B	Bronchiolitis obliterans/Bronchiectasis/Influenza B
A	Age >60/Aspiration/Anaerobic infection/Abscess/Influenza A/Atypical pathogens (eg, Legionella, Mycoplasma, hMPV, chlamydia)
D	Drug-resistant pneumonia from *S. Pneumoniae*, gram-negative bacteria, MRSA, ESBL/Drug-induced pneumonitis (eg, amiodarone, MTX, nitrofurantoin, cancer biologics)/Delayed resolution from corticosteroids
O	Opportunistic pathogens (eg, Fungi, mold, *Pneumocystis Jiroveci*); anaerobic bacteria. Consider HIV testing.
M	Misdiagnosis (fungal infections, sarcoidosis, TB)
E	Embolism/Empyema/Eosinophilic pneumonia
N	Neoplasm/Nosocomial bacterial pneumonia

Hospital Acquired pneumonia - HAP

- HAP is defined as pneumonia that occurs 48 hours or more after admission, which was not incubating at the time of admission.

Ventilator Associated Pneumonia- VAP

- VAP refers to pneumonia that arises more than 48–72 hours after endotracheal intubation .

Health Care Associated Pneumonia HCAP

HCAP)has been excluded from latest HAP/VAP guidelines) includes any patient

- ✓ Who was hospitalized in an acute care hospital for 2 or more days

within 90 days of the infection

- ✓ Resided in a nursing home or long-term care facility

- ✓ Received recent i.v antibiotic therapy, chemotherapy, or wound care within the past 30 days of the current
- infection

epidemology

- HAP is the second most common nosocomial infection and the leading cause of death from nosocomial infections in critically ill patients.
- Its incidence ranges from 5 to more than 20 cases per 1000 hospital admissions
- the highest rates in immunocompromised, surgical and elderly patients .
- The crude mortality rate for HAP may be as high as 30–70%.

Factors that predispose to HAP

Reduced host defences against bacteria

- Reduced immune defences (e.g. corticosteroid treatment, diabetes, malignancy(
- Reduced cough reflex (e.g. post-operative(
- Disordered mucociliary clearance (e.g. anaesthetic agents)
- Bulbar or vocal cord palsy

Factors that predispose to Pneumonia

Aspiration of nasopharyngeal or gastric secretions

- Immobility or reduced conscious level
- Vomiting, dysphagia, achalasia or severe reflux
- Nasogastric intubation

Bacteria introduced into lower respiratory tract

- Endotracheal intubation/tracheostomy
- Infected

Factors that predispose to Pneumonia

Bacteraemia
Abdominal sepsis
Intravenous cannula infection Infected emboli

Etiology

Early-onset HAP (and VAP) is defined as pneumonia occurring within the first 4 days of hospitalization (or endotracheal intubation).It usually carries a better prognosis and is more likely to be caused by antibiotic-sensitive bacteria. The organisms implicated in early-onset HAP are similar to those involved in CAP

Late-onset HAP and VAP (day 5 or thereafter) are more likely to be caused by MDR pathogens, and are associated with higher morbidity and mortality. Late-onset HAP is more often attributable to Gram-negative bacteria (e.g. Escherichia coli, Pseudomonas aeruginosa,

Klebsiella spp. and Acinetobacter baumannii), Staph. aureus (including meticillin-resistant Staph. aureus (MRSA) and Anaerobes.

Clinical features

HAP/VAP should be suspected in any hospitalized/ ventilated patient with symptoms and signs of pneumonia.

The following findings suggest the presence of HAP/ VAP in any patient who has been hospitalized or is being mechanically ventilated and include new or progressive radiologic deterioration along with two of the following: new onset fever, purulent secretions, leukocytosis, and decline in oxygenation

What is the approach to diagnosis of HAP/VAP

HAP/VAP can be clinically defined using modified CDC criteria .

In patients with a strong suspicion of VAP/HAP but insufficient evidence for the presence of infection, periodic re-evaluation should be done .

In patients with suspected VAP/HAP, one or more lower respiratory tract samples and blood should be sent for cultures prior to institution of antibiotics

What is the approach to diagnosis of HAP/VAP

- All patients suspected of having HAP should be further evaluated with good-quality sputum microbiology .
- CT scan should not be routinely obtained for diagnosing HAP/VAP
- Semi-quantitative cultures should be performed in lieu of qualitative cultures .

Management

The principles of management

Are similar to those of CAP focusing on

- ✓ Adequate oxygenation,
- ✓ Appropriate fluid balance
- ✓ Antibiotics

Antibiotic treatment

The choice of empirical antibiotic therapy is considerably more challenging, however, given the diversity of pathogens and the potential for drug resistance.

Risk Factors for Multidrug-Resistant Pathogens

Risk factors for MDR VAP
Prior intravenous antibiotic use within 90 d
Septic shock at time of VAP
ARDS preceding VAP
Five or more days of hospitalization prior to the occurrence of VAP
Acute renal replacement therapy prior to VAP onset
Risk factors for MDR HAP
Prior intravenous antibiotic use within 90 d
Risk factors for MRSA VAP/HAP
Prior intravenous antibiotic use within 90 d
Risk factors for MDR *Pseudomonas* VAP/HAP
Prior intravenous antibiotic use within 90 d

Abbreviations: ARDS, acute respiratory distress syndrome; HAP, hospital-acquired pneumonia; MDR, multidrug resistant; MRSA, methicillin-resistant *Staphylococcus aureus*; VAP, ventilator-associated pneumonia.

Recommended Initial Empiric Antibiotic Therapy for Hospital-Acquired Pneumonia (Non-Ventilator-Associated Pneumonia)

Not at High Risk of Mortality[a] and no Factors Increasing the Likelihood of MRSA[b,c]	Not at High Risk of Mortality[a] but With Factors Increasing the Likelihood of MRSA[b,c]	High Risk of Mortality or Receipt of Intravenous Antibiotics During the Prior 90 d[a,c]
One of the following:	One of the following:	Two of the following, avoid 2 β-lactams:
Piperacillin-tazobactam[d] 4.5 g IV q6h	Piperacillin-tazobactam[d] 4.5 g IV q6h	Piperacillin-tazobactam[d] 4.5 g IV q6h
OR	OR	OR
Cefepime[d] 2 g IV q8h	Cefepime[d] or ceftazidime[d] 2 g IV q8h	Cefepime[d] or ceftazidime[d] 2 g IV q8h
OR	OR	OR
Levofloxacin 750 mg IV daily	Levofloxacin 750 mg IV daily	Levofloxacin 750 mg IV daily
	Ciprofloxacin 400 mg IV q8h	Ciprofloxacin 400 mg IV q8h
	OR	OR
Imipenem[d] 500 mg IV q6h	Imipenem[d] 500 mg IV q6h	Imipenem[d] 500 mg IV q6h
Meropenem[d] 1 g IV q8h	Meropenem[d] 1 g IV q8h	Meropenem[d] 1 g IV q8h
	OR	OR
	Aztreonam 2 g IV q8h	Amikacin 15–20 mg/kg IV daily
		Gentamicin 5–7 mg/kg IV daily
		Tobramycin 5–7 mg/kg IV daily
		OR
		Aztreonam[e] 2 g IV q8h
	Plus: Vancomycin 15 mg/kg IV q8–12h with goal to target 15–20 mg/mL trough level (consider a loading dose of 25–30 mg/kg × 1 for severe illness)	Plus: Vancomycin 15 mg/kg IV q8–12h with goal to target 15–20 mg/mL trough level (consider a loading dose of 25–30 mg/kg IV × 1 for severe illness)
	OR	OR
	Linezolid 600 mg IV q12h	Linezolid 600 mg IV q12h
		If MRSA coverage is not going to be used, include coverage for MSSA. Options include: Piperacillin-tazobactam, cefepime, levofloxacin, imipenem, meropenem. Oxacillin, nafcillin, and cefazolin are preferred for the treatment of proven MSSA, but would ordinarily not be used in an empiric regimen for HAP.
If patient has severe penicillin allergy and aztreonam is going to be used instead of any β-lactam–based antibiotic, include coverage for MSSA.		

Antibiotic treatment

a Risk factors for mortality include need for ventilatory support due to pneumonia and septic shock.
b Indications for MRSA coverage include intravenous antibiotic treatment during the prior 90 days, and treatment in a unit where the prevalence of MRSA among S. aureus isolates is not known
or is >20%. Prior detection of MRSA by culture or non-culture screening may also increase the risk of MRSA.

Suggested Empiric Treatment Options for Clinically Suspected Ventilator-Associated Pneumonia

A. Gram-Positive Antibiotics With MRSA Activity	B. Gram-Negative Antibiotics With Antipseudomonal Activity: β-Lactam–Based Agents	C. Gram-Negative Antibiotics With Antipseudomonal Activity: Non-β-Lactam–Based Agents
Glycopeptides[a] Vancomycin 15 mg/kg IV q8–12h (consider a loading dose of 25–30 mg/kg × 1 for severe illness)	Antipseudomonal penicillins[b] Piperacillin-tazobactam 4.5 g IV q6h[b]	Fluoroquinolones Ciprofloxacin 400 mg IV q8h Levofloxacin 750 mg IV q24h
OR	OR	OR
Oxazolidinones Linezolid 600 mg IV q12h	Cephalosporins[b] Cefepime 2 g IV q8h Ceftazidime 2 g IV q8h	Aminoglycosides[a,c] Amikacin 15–20 mg/kg IV q24h Gentamicin 5–7 mg/kg IV q24h Tobramycin 5–7 mg/kg IV q24h
	OR	OR
	Carbapenems[b] Imipenem 500 mg IV q6h[d] Meropenem 1 g IV q8h	Polymyxins[a,e] Colistin 5 mg/kg IV × 1 (loading dose) followed by 2.5 mg × (1.5 × CrCl + 30) IV q12h (maintenance dose) [135] Polymyxin B 2.5–3.0 mg/kg/d divided in 2 daily IV doses
	OR	
	Monobactams[f] Aztreonam 2 g IV q8h	

Suggested Empiric Treatment Options for Clinically Suspected Ventilator-Associated Pneumonia

Choose one gram-positive option from column A, one gram-negative option from column B, and one gram-negative option from column C.

Note that the initial doses suggested in this table may need to be modified for patients with hepatic or renal dysfunction.

Antibiotic treatment

Antibiotic de-escalation
it is sensible to commence broad-based cover, discontinuing less appropriate antibiotics as culture results become available.

Duration
In the absence of good evidence, the duration of antibiotic therapy remains a matter for clinical judgement.

For patients with HAP/VAP, we recommend a 7-day course of antimicrobial therapy rather than a longer duration
There exist situations in which a shorter or longer duration of antibiotics may be indicated, depending upon the rate of improvement of clinical, radiologic, and laboratory parameters.

Prevention of HAP,VAP

Table 18: Preventive strategies for VAP

The following strategies are recommended in prevention of VAP:
Oral cavity decontamination with 2% chlorhexidine (1A)[412-415]
Hand hygiene preferably using alcohol-based hand rubs or soap and water (1A)[416]
Use of sedation and weaning protocols (1A)[419,420]
Use of NIV to avoid intubation, where feasible (1A)[264,421]
Subglottic secretion drainage (2A)[422,423]
Heat moisture exchangers in place of heated humidifiers (2A)[424-428]
Closed suction systems (2A)[429-431]
Use of orotracheal intubation as opposed to nasotracheal intubation (2A)[432,433]
Proper and timely disposal of condensates (3A)[434,435]
Maintaining tracheal cuff pressures <25 cm H_2O (2A)[436]
Wipe stethoscopes with alcohol rubs (2A)[437]
Regular postural mobilization to prevent stasis of secretions (2A)
Use of only normal saline for suctioning (3A)
Proper sterilization of nebulizer and other chambers (2A)
Head end elevation to 30°–45° (2A)
The following strategies are not recommended in prevention of VAP:
Antibiotics for prevention of VAP (2A)
Selective digestive tract decontamination (2A)[438]
Routine ventilator circuit changes (2A)[439,440]
Early tracheostomy (2A)

Stress bleeding prophylaxis, transfusion, and hyperglycemia.

1. Comparative data from randomized trials suggest a trend toward reduced VAP with sucralfate, but there is a slightly higher rate of clinically significant gastric bleeding, compared with H_2 antagonists. If needed, stress bleeding prophylaxis with either H_2 antagonists or sucralfate is acceptable (**Level I**) (99–104, 155, 177–179).
2. Transfusion of red blood cell and other allogeneic blood products should follow a restricted transfusion trigger policy; leukocyte-depleted red blood cell transfusions can help to reduce HAP in selected patient populations (**Level I**) (169–174).
3. Intensive insulin therapy is recommended to maintain serum glucose levels between 80 and 110 mg/dl in ICU patients to reduce nosocomial blood stream infections, duration of mechanical ventilation, ICU stay, morbidity, and mortality (**Level I**) (175).

Suppurative pneumonia, aspiration pneumonia and pulmonary abscess

Suppurative pneumonia, aspiration pneumonia and pulmonary abscess

- These conditions are considered together as their aetiology and clinical features overlap
- Aspiration pneumonia is best considered not as a distinct entity

but as part of a continuum that also includes community- and hospital acquired pneumonias.

- It is estimated that aspiration pneumonia accounts for 5 to 15% of cases of community-acquired pneumonia.
- Suppurative pneumonia is characterized by destruction of the lung parenchyma by the inflammatory process. Although microabscess formation is a characteristic histological feature, ‘pulmonary abscess’ is usually taken to refer to

Pathology and risks factors

- Large-volume aspiration (macroaspiration) of colonized oropharyngeal or upper gastrointestinal contents is the sine qua non of aspiration pneumonia
- Macroaspiration can occur as a result of abnormalities in the swallowing mechanism or altered swallowing due to dysfunction of the central nervous system. In patients with these disorders, oropharyngeal or gastric contents can enter the lung. An impaired cough reflex increases the likelihood that aspirated material will reach the lung.

Pathogenesis and risk factors for the development of pneumonia after macroaspiration

Risk Factors

Impaired swallowing

Esophageal disease: dysphagia, cancer, stricture

Chronic obstructive pulmonary disease

Neurologic diseases: seizures, multiple sclerosis, parkinsonism, stroke, dementia

Mechanical ventilation extubation

Impaired consciousness

Neurologic disease: stroke

Cardiac arrest

Medications

General anesthesia

Alcohol consumption

Increased chance of gastric contents reaching the lung

Reflux

Tube feeding

Impaired cough reflex

Medications

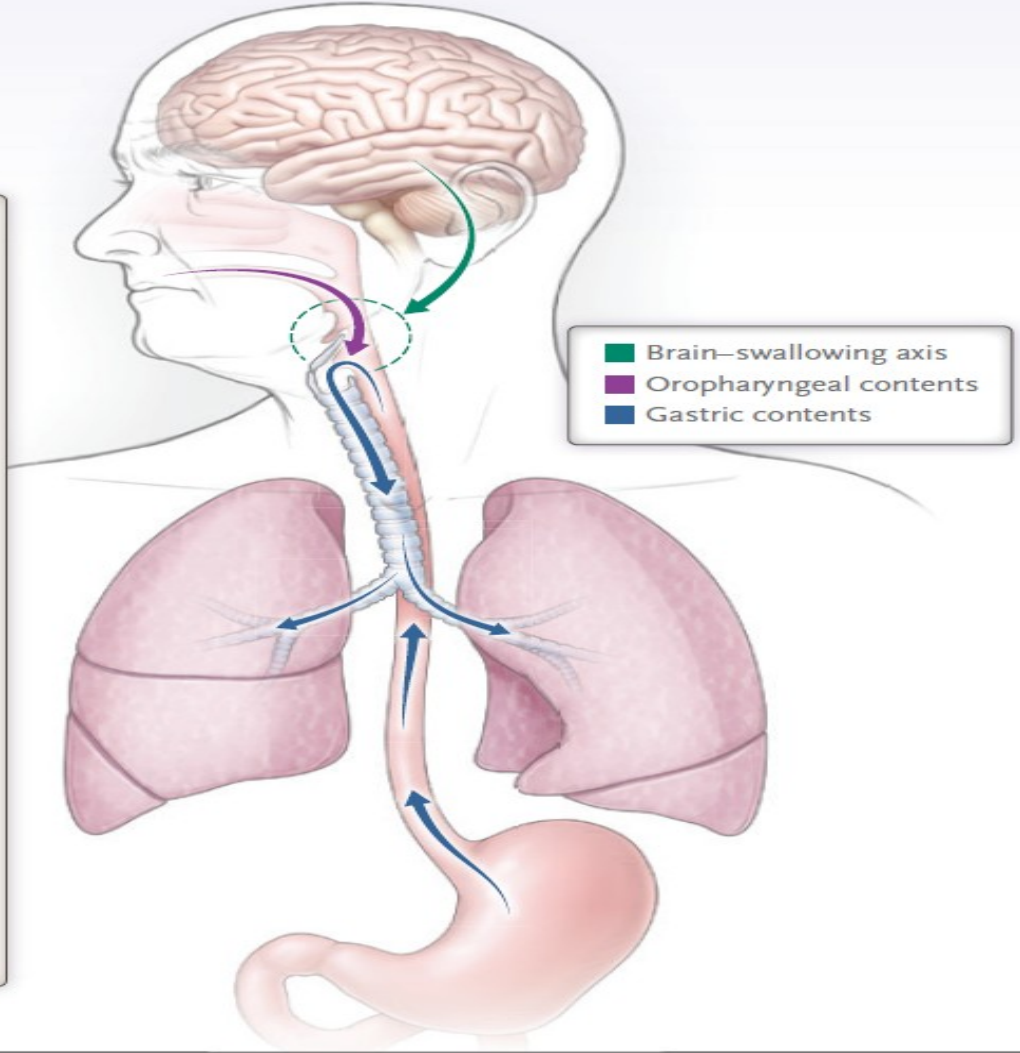
Alcohol

Stroke

Dementia

Degenerative neurologic disease

Impaired consciousness



MICROBIOLOGY

- Infections are usually due to a mixture of anaerobes and aerobes in common with the typical flora encountered in the mouth
and upper respiratory tract. Isolates of Prevotella melaninogenica,
Fusobacterium necrophorum, anaerobic or microaerophilic cocci,
and Bacteroides fragilis may be identified.
- When suppurative pneumonia or a pulmonary abscess occurs in a previously healthy lung, the most likely infecting organisms are Staph. aureus or K. pneumoniae.
- Actinomyces infections (mostly A. israelii) cause chronic suppurative pulmonary infections, which may be associated

MICROBIOLOGY

- Bacterial infection of a pulmonary infarct or a collapsed lobe may also produce a suppurative pneumonia or lung abscess. The organism(s) isolated from the sputum include Strep. pneumoniae, Staph. aureus, Streptococcus pyogenes, H. influenzae and, in some cases, anaerobic bacteria. In many cases, however, no pathogen can be isolated, particularly when antibiotics have been given.
- Some strains of community-acquired MRSA (CA-MRSA) produce the cytotoxin Panton–Valentine leukocidin. The organism is mainly responsible for suppurative skin infection but may be associated with rapidly progressive severe

MICROBIOLOGY

- Lemierre’s syndrome is a rare cause of pulmonary abscesses.

The usual causative agent is the anaerobe Fusobacterium necrophorum. The illness typically commences as a sore throat painful swollen neck, fever, rigor, haemoptysis and dyspnoea; spread into the jugular veins leads to thrombosis and metastatic
dispersal of the organisms

- Injecting drug-users are at particular risk of developing haematogenous lung abscess, often in association with endocarditis affecting the pulmonary and tricuspid valves.
- A non-infective form of aspiration pneumonia – exogenous lipid pneumonia – may follow the aspiration of animal,

Clinical features of suppurative

Symptoms

- Cough with large amounts of sputum, sometimes fetid and blood-stained
- Pleural pain common
- Sudden expectoration of copious amounts of foul sputum if abscess ruptures into a bronchus

Clinical signs

- High remittent pyrexia
- Profound systemic upset
- Digital clubbing may develop quickly (10–14 days)
- Consolidation on chest examination; signs of cavitation rarely found
- Pleural rub common
- Rapid deterioration in general health, with marked weight loss if not adequately treated

Diagnosis

- As other types of pneumonia

- The diagnosis of aspiration pneumonia depends on a characteristic clinical history (witnessed macroaspiration), risk factors, and compatible findings on chest radiography. These radiographic findings include infiltrates in gravity-dependent lung segments or homogeneous lobar or segmental opacity consistent with consolidation or collapse (superior lower-lobe or posterior upper-lobe segments, if the patient is in a supine position during the event, or basal segments of the lower lobe, if the patient is upright during the event.
- Abscesses are characterised by cavitation and fluid level. Occasionally, a preexisting emphysematous bulla becomes infected and appears as a cavity containing an air–fluid level

Treatment

- Aspiration pneumonia can be treated with intravenous co-amoxiclav 1.2 g 3 times daily. If an anaerobic bacterial infection is suspected (e.g. from fetor of the sputum), oral metronidazole 400 mg 3 times daily should be added. Clindamycin iv or oral can be used alone .
- Further modification of antibiotics may be required, depending on the clinical response and the microbiological results.
- CA-MRSA is usually susceptible to a variety of oral non-β-lactam antibiotics, such as trimethoprim/sulfamethoxazole, clindamycin, tetracyclines and linezolid.
- Parenteral therapy with vancomycin or daptomycin can also be considered. F. necrophorum is highly susceptible to β-

Treatment

- Established pulmonary actinomycosis requires 6–12 months' treatment with intravenous or oral penicillin, or with a tetracycline in penicillin-allergic patients.
- Prolonged treatment for 4–6 weeks may be required in some patients with lung abscess.
- Physiotherapy

is of great value, especially when suppuration is present in the lower lobes or when a large abscess cavity has formed.

- Surgery should be contemplated if no improvement occurs, despite optimal medical therapy.

Prevention of Aspiration Pneumonia

Recommended in the appropriate clinical setting

Antibiotic therapy for 24 hr in comatose patients after emergency intubation

No food for at least 8 hr and no clear liquids for at least 2 hr before elective surgery with general anesthesia

To be considered in the appropriate clinical setting

Swallowing evaluation after stroke and after extubation from mechanical ventilation

Preference for angiotensin-converting–enzyme inhibitors for blood-pressure control after stroke

Oral care with brushing and removal of poorly maintained teeth

Feeding in a semirecumbent position for patients with stroke

Not yet recommended; more data needed

Swallowing exercises for patients with dysphagia after stroke

Oral chlorhexidine in patients at risk for aspiration

ELDERLY

- Infection has a more gradual onset, with less fever and cough
- often with a decline in mental status or confusion and generalized weakness
- often with less readily elicited signs of consolidation

Pneumonia in the immunocompromised patient

- Patients immunocompromised by drugs or disease (particularly human immunodeficiency virus (HIV) infection are at increased risk of pulmonary infection and pneumonia is the most common cause of death in this group.
- Etiology

The majority of infections are caused by the same pathogens that cause pneumonia in immunocompetent individuals, but in patients with more profound immunosuppression less common organisms, or those normally considered to be of low virulence or non-pathogenic, may become 'opportunistic' pathogens. Depending on the clinical context, clinicians should consider the possibility of Gram-negative bacteria, especially P. aeruginosa, viruses, fungi, mycobacteria, and less common organisms such as Nocardia spp.

Infection s often due to more than one organism

Causes of immune suppresion associated infections

	Causes	Infecting organisms
Defective phagocytic function	Acute leukaemia Cytotoxic drugs Agranulocytosis	Gram-positive bacteria, including *Staph. aureus* Gram-negative bacteria Fungi, e.g. *Candida albicans* and *Aspergillus fumigatus*
Defects in cell-mediated immunity	Immunosuppressive drugs Cytotoxic chemotherapy Lymphoma Thymic aplasia	Viruses Cytomegalovirus Herpesvirus Adenovirus Influenza Fungi *Pneumocystis jirovecii* (formerly *carinii*) *Candida albicans* *Aspergillus fumigatus*
Defects in antibody production	Multiple myeloma Chronic lymphocytic leukaemia	*Haemophilus influenzae* *Mycoplasma pneumoniae*

Clinical features

- These typically include fever, cough and breathlessness but are influenced by the degree of immunosuppression
- The presentation may be less specific in the more profoundly immunosuppressed.
- The onset of symptoms tends to be swift In those with a bacterial infection but more gradual in patients with opportunistic organisms such as Pneumocystis jirovecii and mycobacterial infections .
- In P. jirovecii pneumonia, symptoms of cough and breathlessness can be present several days or weeks before the onset of systemic symptoms or the appearance of radiographic abnormality

Investigations

The approach is informed by the clinical context and severity of the illness

- ‘induced sputum’ offers a relatively safe method of obtaining microbiological samples.
- HRCT can be helpful:

• focal unilateral airspace opacification favours bacterial infection, mycobacteria or Nocardia
• bilateral opacification favours P. jirovecii pneumonia, fungi, viruses and unusual bacteria, e.g. Nocardia
• cavitation may be seen with N. asteroides, mycobacteria and fungi
• the presence of a ‘halo sign’ (a zone of intermediate attenuation between the nodule and the lung parenchyma) may suggest aspergillosis
• pleural effusions suggest pyogenic bacterial infections and are uncommon in P. jirovecii pneumonia

Treatment

- In theory, treatment should be based on an established aetiological diagnosis; in practice, however, the causative agent
is frequently unknown.
- Factors that favour a bacterial aetiology include neutropenia, rapid onset and deterioration. In these circumstances, broad-spectrum antibiotic therapy should be commenced immediately, e.g. a third-generation cephalosporin, or a quinolone, plus an antistaphylococcal antibiotic, or an antipseudomonal penicillin plus an aminoglycoside. Thereafter, treatment may be tailored according to the results of investigations and the clinical response.

Mycoplasma pneumonia

- A common respiratory pathogen that produces diseases of varied severity ranging from mild upper respiratory tract infection to severe atypical pneumonia. Although rarely fatal, M. pneumoniae is an important cause of acute respiratory tract infection, especially as a potential etiology of the clinical entity termed (atypical pneumonia).
- Mycoplasma pneumoniae is more common in young people and rare in the elderly.
- The clinical presentation of M. pneumoniae respiratory disease is often similar to what is seen with other atypical pathogens, particularly Chlamydia pneumoniae, various respiratory viruses and bacteria
- Extra pulmonary manifestations during M. pneumoniae

Extra pulmonary manifestations of M. pneumoniae infection

Neurological manifestations	Aseptic meningitis
	Meningo encephalitis
	Cerebro vascular accidents
	Hemiplegia
	Transeverse myelitis, ascending paralysis
	Cranial nerve palsy, cerebellar atxia
	Optic neuritis, polyradiculopathy
	Peripheral neuropathy
	Guillain-Barr'e syndrome
Musculoskeletal	Arthralgias myalgias
	Septic arthritis,
	Polyarthritis
	Acute rhabdomyolysis
Hematological	Hemolytic anemia
	Thrombotic thrombocytopenia purpura
	Intravascular coagulation
	Hemophagocytic syndrome
Cardiovascular	Pericarditis, myocarditis
	Endocarditis, CCF
	Pericardial effusion
	Raynaud's phenomenon
Dermatological	Skin rashes
	Stevens-Johnson syndrome
	Erythemanodosum
	Bullous erythem a multiforme
Gastrointestinal	Diarrhea, pancreatitis
	Cholestatic hepatitis
	Hypoechoic lesions in spleen
Renal	Acute glomerulonephritis, IgA nephropathy
	Tubulointerstitial nephritis, renal failure

Mycoplasma pneumonia

Radiology

manifested radiographically as diffuse, reticular infiltrates of bronchopneumonia in the perihilar regions or lower lobes, usually with a unilateral distribution, and hilar adenopathy. Bilateral involvement may occur in about 20% of cases

Treatment

Good response to macrolides and quinolones ,not to B lactam

Conclusion

- The presence of an infiltrate on plain chest radiograph is considered the "gold standard" for diagnosing pneumonia when clinical and microbiologic features are supportive
- Most initial treatment regimens for hospitalized patients with community-acquired pneumonia (CAP) are empiric
- The mortality rate associated with community-acquired pneumonia (CAP) is very low in most ambulatory patients and higher in patients requiring hospitalization

67 y/o woman from Mandi who has a 2-day history of productive cough, fever, and altered behavior is brought to the casualty.

Vital Signs: BT 101.2 F, BP 140/80 mmHg, HR 120/min, RR 30/min, SpO_2 91% (room air)

Examn: crepts in B/L I/S I/A area
disoriented to time/place/person

Lab: WBC 4500, Na^+ 130, BUN 25

CXR: infiltrates in both lower lobes

Where should this patient be treated ?

Which initial antibiotics should she be started on ?

Remember

- CURB 65
- COMMON PRESENTATION OF STREPTOCOCCAL PNEUMONIA
- MYCOPLASMA EXTRAPULMONARY MANEFESTATIONS
- CAUSES OF UNRESOLVING PNEUMONIA
- COMPLICATIONS OF PNEUMONIA
- CONSOLIDATION SIGNS

Suggested home activity

- Most common extra pulmonary complication of mycoplasma pneumonia?
- Indications of pneumococcal vaccines .

THANK YOU!!!